

Claims

What is claimed is:

1. A reconfigurable filter comprising:
  - 5 a filtering stage having a bandwidth configured by a bandwidth control signal and a frequency offset configured by an offset control signal, the filtering stage adapted to filter an amplified input signal, thereby providing an output signal; and
    - 10 a reverse gain stage adapted to provide the offset control signal based on a reverse gain control signal and the output signal,
      - 15 wherein the configuration of the bandwidth and the frequency offset allows the reconfigurable filter to realize a desired filter pole.
  2. The reconfigurable filter of claim 1 wherein the bandwidth is configured independently from the frequency offset and the frequency offset is configured independently from the bandwidth.
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  3. The reconfigurable filter of claim 1 further comprising a forward gain stage adapted to amplify an input signal to provide the amplified input signal to the filtering stage.
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  4. The reconfigurable filter of claim 3, wherein the forward gain stage has a gain configured by a forward gain control signal.
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  5. The reconfigurable filter of claim 4 wherein the gain is configured independently from the bandwidth and the frequency offset, the bandwidth is configured independently from the gain and the frequency offset, and the frequency offset is configured independently of the gain and the bandwidth.
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  6. The reconfigurable filter of claim 4 wherein the forward gain stage comprises at least one variable resistor having a resistance value controlled by the forward gain control signal.
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7. The reconfigurable filter of claim 4 wherein the forward gain stage comprises at least one first variable resistor having a first resistance controlled by the forward gain control signal, the filtering stage comprises at least one second variable resistor having a second resistance controlled by  
5 the bandwidth control signal, and the reverse gain stage comprises at least one third variable resistor having a third resistance controlled by the reverse gain control signal.

8. The reconfigurable filter of claim 4 wherein the forward gain stage  
10 comprises at least one first variable resistor having a first resistance controlled by the forward gain control signal, the filtering stage comprises at least one variable capacitor having a capacitance controlled by the bandwidth control signal, and the reverse gain stage comprises at least one second variable resistor having a second resistance controlled by the reverse gain  
15 control signal.

9. The reconfigurable filter of claim 4 wherein the forward gain stage comprises at least one first variable resistor having a first resistance controlled by the forward gain control signal, the filtering stage comprises at  
20 least one variable capacitor having a capacitance controlled by the bandwidth control signal and at least one second variable resistor having a second resistance controlled by the bandwidth control signal, and the reverse gain stage comprises at least one third variable resistor having a third resistance controlled by the reverse gain control signal.  
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10. The reconfigurable filter of claim 4 wherein the forward gain control signal, the reverse gain control signal, and the bandwidth control signal are provided by control logic.

30 11. The reconfigurable filter of claim 1 wherein the reconfigurable filter is a polyphase filter.

12. The reconfigurable filter of claim 1 wherein the reconfigurable filter operates as a low-pass filter when the frequency offset is zero and a band-pass filter when the frequency offset is greater than zero.
- 5    13. The reconfigurable filter of claim 1 wherein the filtering stage comprises at least one variable resistor having a resistance value controlled by the bandwidth control signal.
- 10    14. The reconfigurable filter of claim 1 wherein the filtering stage comprises at least one variable capacitor having a capacitance controlled by the bandwidth control signal.
- 15    15. The reconfigurable filter of claim 1 wherein the filtering stage comprises at least one variable resistor and at least one variable capacitor each controlled by the bandwidth control signal.
- 20    16. The reconfigurable filter of claim 1 wherein the reverse gain stage comprises at least one variable resistor having a resistance controlled by the reverse gain control signal.
- 25    17. A method for providing a reconfigurable filter comprising the steps of:  
filtering an amplified input signal to provide an output signal, the filtering step having a bandwidth configured by a bandwidth control signal and a frequency offset configured by an offset control signal; and  
amplifying the output signal based on a reverse gain control signal, thereby providing the offset control signal,  
wherein the configuration of the bandwidth and the frequency offset allows the reconfigurable filter to realize a desired filter pole.
- 30    18. The method of claim 17 wherein the bandwidth is configured independently from the frequency offset and the frequency offset is configured independently from the bandwidth.

19. The method of claim 17 further comprising amplifying an input signal to provide the amplified input signal to the filtering step.

20. The method of claim 19, wherein the amplifying step has a gain  
5 configured by a forward gain control signal.

21. The method of claim 20 wherein the gain is configured independently from the bandwidth and the frequency offset, the bandwidth is configured independently from the gain and the frequency offset, and the frequency  
10 offset is configured independently of the gain and the bandwidth.

22. The method of claim 20 wherein the amplifying the input signal step comprises controlling at least one variable resistor based on the forward gain control signal.

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23. The method of claim 20 wherein the amplifying the input signal step comprises controlling at least one first variable resistor having a first resistance based on the forward gain control signal, the filtering step comprises controlling at least one second variable resistor having a second resistance based on the bandwidth control signal, and the amplifying the output signal step comprises controlling at least one third variable resistor having a third resistance based on the reverse gain control signal.

24. The method of claim 20 wherein the amplifying the input signal step  
25 comprises controlling at least one first variable resistor having a first resistance based on the forward gain control signal, the filtering step comprises controlling at least one variable capacitor having a capacitance based on the bandwidth control signal, and the amplifying the output signal step comprises controlling at least one second variable resistor having a second resistance based on the reverse gain control signal.

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25. The method of claim 20 wherein the amplifying the input signal step comprises controlling at least one first variable resistor having a first resistance based on the forward gain control signal, the filtering step

comprises controlling at least one variable capacitor having a capacitance based on the bandwidth control signal and controlling at least one second variable resistor having a second resistance based on the bandwidth control signal, and the amplifying the output signal step comprises controlling at least

- 5 one third variable resistor having a third resistance based on the reverse gain control signal.

26. The method of claim 17 wherein the reconfigurable filter is a polyphase filter.

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27. The method of claim 17 wherein the filtering step operates to low-pass filter the amplified input signal when the frequency offset is zero and to band-pass filter the amplified input signal when the frequency offset is greater than zero.

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28. The method of claim 17 wherein the filtering step comprises controlling at least one variable resistor based on the bandwidth control signal.

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29. The method of claim 17 wherein the filtering step comprises controlling at least one variable capacitor based on the bandwidth control signal.

30. The method of claim 17 wherein the filtering step comprises controlling at least one variable resistor and at least one variable capacitor based on the bandwidth control signal.

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31. The method of claim 17 wherein the amplifying the output signal step comprises controlling at least one variable resistor based on the reverse gain control signal.

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32. A reconfigurable  $N^{\text{th}}$  order filter comprising:

a number  $N$  of cascaded reconfigurable filters, each of the reconfigurable filters comprising:

a filtering stage having a bandwidth configured by a bandwidth control signal and a frequency offset configured by an offset control

- signal, the filtering stage adapted to filter an input signal, thereby providing an output signal; and
- a reverse gain stage adapted to provide the offset control signal based on a reverse gain control signal and the output signal,
- 5       wherein the number N corresponds to a number of poles realized by the N<sup>th</sup> order filter and the configuration of the bandwidth and the frequency offset of each of the reconfigurable filters allows each of the reconfigurable filters to realize a desired filter pole.
- 10      33.     The reconfigurable N<sup>th</sup> order filter of claim 32 wherein the bandwidth of each of the reconfigurable filters is configured independently from the frequency offset and the frequency offset is configured independently from the bandwidth.
- 15      34.     The reconfigurable N<sup>th</sup> order filter of claim 32 wherein each of the reconfigurable filters further comprises a forward gain stage adapted to amplify the input signal prior and provide an amplified version of the input signal to the filtering stage.
- 20      35.     The reconfigurable N<sup>th</sup> order filter of claim 34, wherein the forward gain stage of each of the reconfigurable filters has a gain configured by a forward gain control signal.
- 25      36.     The reconfigurable N<sup>th</sup> order filter of claim 35 wherein the gain of each of the reconfigurable filters is configured independently from the bandwidth and the frequency offset, the bandwidth is configured independently from the gain and the frequency offset, and the frequency offset is configured independently of the gain and the bandwidth.
- 30      37.     The reconfigurable filter of claim 35 wherein the forward gain control signal, the reverse gain control signal, and the bandwidth control signal are provided by control logic.